CLAIMS

We claim:

1. A method of examining a structure formed on a semiconductor wafer, the method comprising:

directing an incident beam at the structure at an incidence angle and an azimuth angle;

scanning the incident beam over a range of azimuth angles to obtain an azimuthal scan; and

measuring the cross polarization components of diffracted beams during the azimuthal scan.

2. The method of claim 1, wherein the incident beam is polarized at a polarization angle of zero or 90 degrees.

3. The method of claim 1, further comprising:

determining a zero azimuth position based on the azimuthal scan, wherein the cross polarization components are zero at the zero azimuth position.

4. The method of claim 3, wherein the range of azimuth angles is around the zero azimuth position.

5. The method of claim 3, further comprising:

obtaining a measured diffraction signal using an azimuth angle to be used in optical metrology of the structure, wherein the azimuthal scan is performed before the measured diffraction signal is obtained; and

detecting azimuthal misalignment of the measured diffraction signal to a simulated diffraction signal based on the determined zero azimuth position.

6. The method of claim 5, wherein the simulated diffraction signal was generated using an assumed zero azimuth position, and wherein azimuthal misalignment of the

measured diffraction signal is detected when the determined zero azimuth position differs from the assumed zero azimuth position.

7. The method of claim 1, wherein the structure is a contact hole array, and further comprising:

determining whether a contact hole in the contact hole array is asymmetric based on the azimuthal scan.

8. The method of claim 7, wherein the contact hole is determined to be asymmetric when the cross polarization components are not zero at an azimuth angle of one or more of 45, 135, 225, and 315 degrees.

9. The method of claim 7, further comprising:

testing a lens used in lithography based on determining whether the contact hole in the contact hole array is asymmetric.

10. The method of claim 1, further comprising:

determining rotation of the structure based on the azimuthal scan.

11. The method of claim 10, wherein rotation of the structure is determined when the cross polarization terms reach a minimum but are not zero, and the cross polarization terms are not symmetric about the minimum.

12. The further of claim 11, further comprising:

obtaining a spectrum at two azimuth angles symmetric about the minimum; and

determining a difference signal based the spectrum obtained at the two azimuth angles, wherein rotation of the structure is determined when the difference signal is not zero, and wherein a direction of the rotation is determined based on the sign of the difference signal.

13. A system for examining a three dimensional structure formed on a semiconductor wafer, the system comprising:

a source to direct an incident beam at the structure at an incidence angle and an azimuth angle,

wherein the incident beam is scanned over a range of azimuth angles to obtain an azimuthal scan; and

a detector to measure the cross polarization components of diffracted beams during the azimuthal scan.

14. The system of claim 13, wherein the incident beam is polarized at a polarization angle of zero or 90 degrees.

15. The system of claim 13, wherein a zero azimuth position is determined based on the azimuthal scan, and wherein the cross polarization components are zero at the zero azimuth position.

16. The system of claim 15, wherein the range of azimuth angles is around the zero azimuth position.

17. The system of claim 15, wherein a measured diffraction signal is obtained using an azimuth angle to be used in optical metrology of the structure, wherein the azimuthal scan is performed before the measured diffraction signal is obtained, and wherein azimuthal misalignment of the measured diffraction signal to a simulated diffraction signal is detected based on the determined zero azimuth position.

18. The system of claim 17, wherein the simulated diffraction signal was generated using an assumed zero azimuth position, and wherein azimuthal misalignment of the measured diffraction signal is detected when the determined zero azimuth position differs from the assumed zero azimuth position.

19. The system of claim 13, wherein the 3-D structure is a contact hole array, and wherein a contact hole in the contact hole array is determined to be asymmetric based on the azimuthal scan.

20. The system of claim 19, wherein the contact hole is determined to be asymmetric when the cross polarization components are not zero at an azimuth angle of one or more of 45, 135, 225, and 315 degrees.

21. The system of claim 19, wherein a lens used in lithography is tested based on determining whether the contact hole in the contact hole array is asymmetric.

22. The system of claim 13, wherein rotation of the structure is determined based on the azimuthal scan.

23. The system of claim 22, wherein rotation of the structure is determined when the cross polarization terms reach a minimum but are not zero, and the cross polarization terms are not symmetric about the minimum.

24. The system of claim 23, wherein a spectrum at two azimuth angles symmetric about the minimum is obtained, and wherein a difference signal is determined based the spectrum obtained at the two azimuth angles, wherein rotation of the structure is determined when the difference signal is not zero, and wherein a direction of the rotation is determined based on the sign of the difference signal.

25. A method of examining a structure formed on a semiconductor wafer, the method comprising:

scanning an incident beam over a range of azimuth angles to obtain an azimuthal scan;

measuring the cross polarization components of diffracted beams during the azimuthal scan; and

based on the azimuthal scan, determining one or more of conditions including:

a) a zeroth azimuth position, wherein the cross polarization components are zero at the zero azimuth position;

b) symmetry of a contact hole in a contact hole array; and

c) rotation of the structure.